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ABSTRACT

This paper is the third in a series exploring the impact of changing proportions of youth in our society. It describes an empirical test of the assertion that there is delay between population changes and societal response, even when those population changes are known in advance. For this study the social institution of schools was examined. Hypotheses were proposed based on the theory of demographic discontinuity (see SO 013 568); data used were teacher pupil ratios and personal consumption expenditures for the period 1929-30 to 1975-76. It was found that there is indeed a delay in society's response to rapid changes in the youth population, but that ultimately society does accommodate. The data are more supportive of the assertion as it relates to the number of youth than to youth as a percent of the total population. However, there were only two abrupt, major reversals in the size of the youth population during the period studied. Within that limitation, the assertion is supported reasonably well. (Author/AV)

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Personal Consumption Expenditures, Numerical Changes in the School Age Population, and Pupil-Teacher Ratio

1979

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SO 013 570

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Personal Consumption Expenditures, Numerical Changes in the School Age Population, and Teacher-Pupil Ratio

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Introduction

In a recent paper Egbert, et. al. (1979) hypothesized a relationship between changes in the size of the youth population and certain events and trends in society. The theme of that paper is that rapid numerical and/or percent-of-the-population changes in the youth cohort have both direct and indirect impacts on society and that, by understanding these impacts society can more easily accommodate to them. One of the impacts predicted for numerical or percent changes in the youth population is that because society does not prepare in advance for future requirements, even when those requirements are obvious, there will be a delay between population changes and related modifications in funding patterns. Adjustments ultimately will be made, but in the mean time institutions serving youth (a) will be relatively underfunded during periods of rapid increase in the youth populations, thus creating stress between the youth and the under-staffed institution serving them, and (b) will be relatively overfunded during the first part of periods of rapid decrease, thus resulting in a higher staff to client ratio. This assertion was offered as a partial explanation of our failure to socialize youth in the 1960's.

Recent increase in the teacher-pupil ratio during the same period that the school population was rapidly declining was cited as evidence for the assertion concerning society's delayed response. A reviewer of Egbert, et. al. questioned the validity of this evidence, noting that the teacher-pupil ratio has improved (increased) during periods of both decreasing and increasing

youth population. On the other hand, a study of Colorado schools (Rodekohr & Rodekohr, 1976) supported Egbert's assertion, i.e., Colorado schools with declining enrollments had higher teacher-pupil ratios (more teachers for the same number of pupils) than did schools with increasing enrollments. To provide another test of the assertion we conducted the present study.

The purpose of this study, then, was to provide a more direct empirical test of the assertion that, when there is an abrupt change in the numbers of children and youth in the population there is a delay in society's response to that change followed ultimately by accommodation.

The independent variable studied was the size of the school aged population in the U.S. from 1929-30 to 1974-75. Two indices were used: (a) number of school aged youth, and (b) percent that school aged youth were of the total population. The dependent variable was teacher-pupil ratio. For convenience this was expressed as the number of teachers per 100 pupils.

It was assumed that society's financial condition would have a bearing on how much it would be willing to spend on education. Consequently, personal consumption expenditure was used as a control variable.

Information for teacher pupil ratio was taken from Digest of Education Statistics and the Biennial Survey of Education in the U.S. Data were available only on a bi-annual basis, i.e., 1929-30, 1931-32, 1933-34, etc. Information for personal consumption expenditures (PCE) is from the Economic Report of the President for 1972 and 1979. Personal consumption expenditure (PCE) data as expressed in 1972 constant dollars were used as the basis for computing annual PCE per school age youth.

Data Presentation

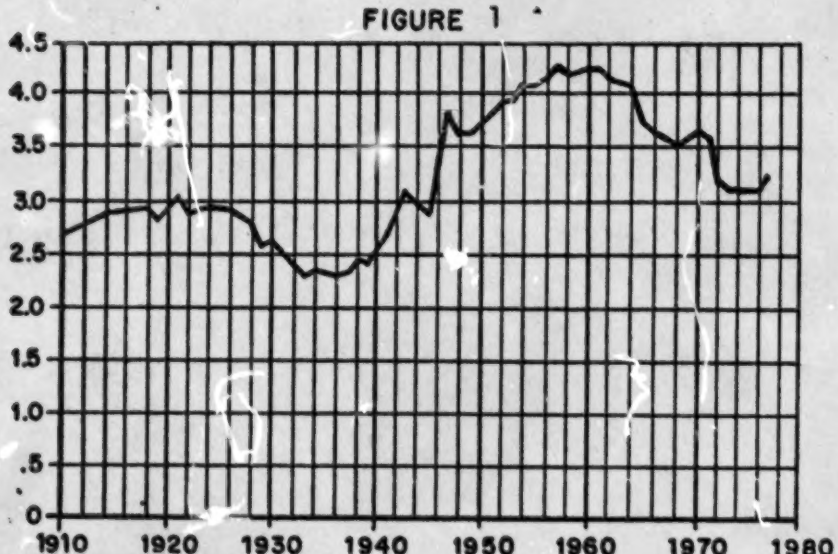
Data are presented in two forms, for separate purposes. The first purpose for the data is to establish a common base of knowledge. The second

purpose is to permit making the comparisons implicit in the hypothetical statements presented.

To set a common base, data are presented in Figures 1-8 showing (a) number of births in the United States, 1910-1978; (b) population of the United States, 1929-1978; (c) number of school age youth, 1929-1977; (d) percent that school age youth are of the total population, 1929-1977; (e) personal consumption expenditures (PCE) in the U.S. 1929-1977; (f) PCE per school age youth, 1929-1977; (g) number of teachers, and (h) teacher-pupil ratio.

Figure 1 gives the number of births in the United States from 1910 to 1978. The pattern of births shown is well known--a reasonably constant twenty-year period (1910-1930) of between 2.5 and 3.0 million births annually, a drop to a depression years low of about 2.4M, and then a rapid increase to almost 4.3M annual births in the late 1950's followed by a sharp decrease to very little over 3.1M, with some slight increase for each of the past three years (including 1979).

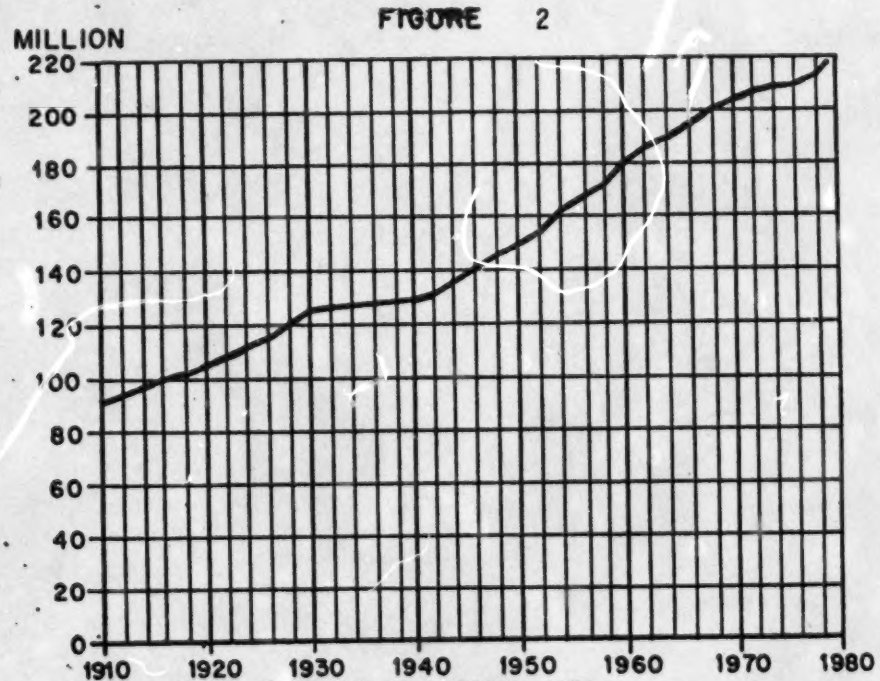
FIGURE 1



'NUMBER OF BIRTHS: 1910-1977
SOURCE: VITAL STATISTICS OF THE U.S. VOL. I, TABLE 1-2 (1910-1975)
MONTHLY VITAL STATISTICS REPORT, ANNUAL SUMMARY FOR THE U.S., 1977 (VOL. 26, #13, DEC. 7, 1978) TABLE A (1976-1977)

Figure 2 shows the total population of the U.S., on a biennial basis, from 1929-30 to 1977-78. Overall, the pattern is one of constant growth in the population for this fifty year period, increasing from just over 120M in 1929-30 to slightly less then 220M for 1977-78. However, overlaid on this rather consistent growth curve is a slightly more flattened slope from 1929 to 1943, a steeper slope until the late sixties, and then another flattening. This very faint S-shape is a function of the changing birth, survival, and immigration rates.

FIGURE 2



U.S. TOTAL POPULATION (MILLIONS) 1910-1979
SOURCE: HISTORICAL STATISTICS OF THE U.S., COLONIAL TIMES TO 1970, PART I (1910-1970). CURRENT POPULATION REPORTS, SERIES P-25, #704, TABLE 1 (1971-1975) AND TABLE 2 (1976-1979).

Figure 3 is a graph of the number of school aged youth from 1929-30 to 1977-78. The pattern of this graph follows closely the one in Figure 1 except that everything is delayed by about ten years, approximately the average age of persons in grades K-12. Because date in Figure 3 span a thirteen year age range, year-to-year fluctuations are smoothed, the slopes

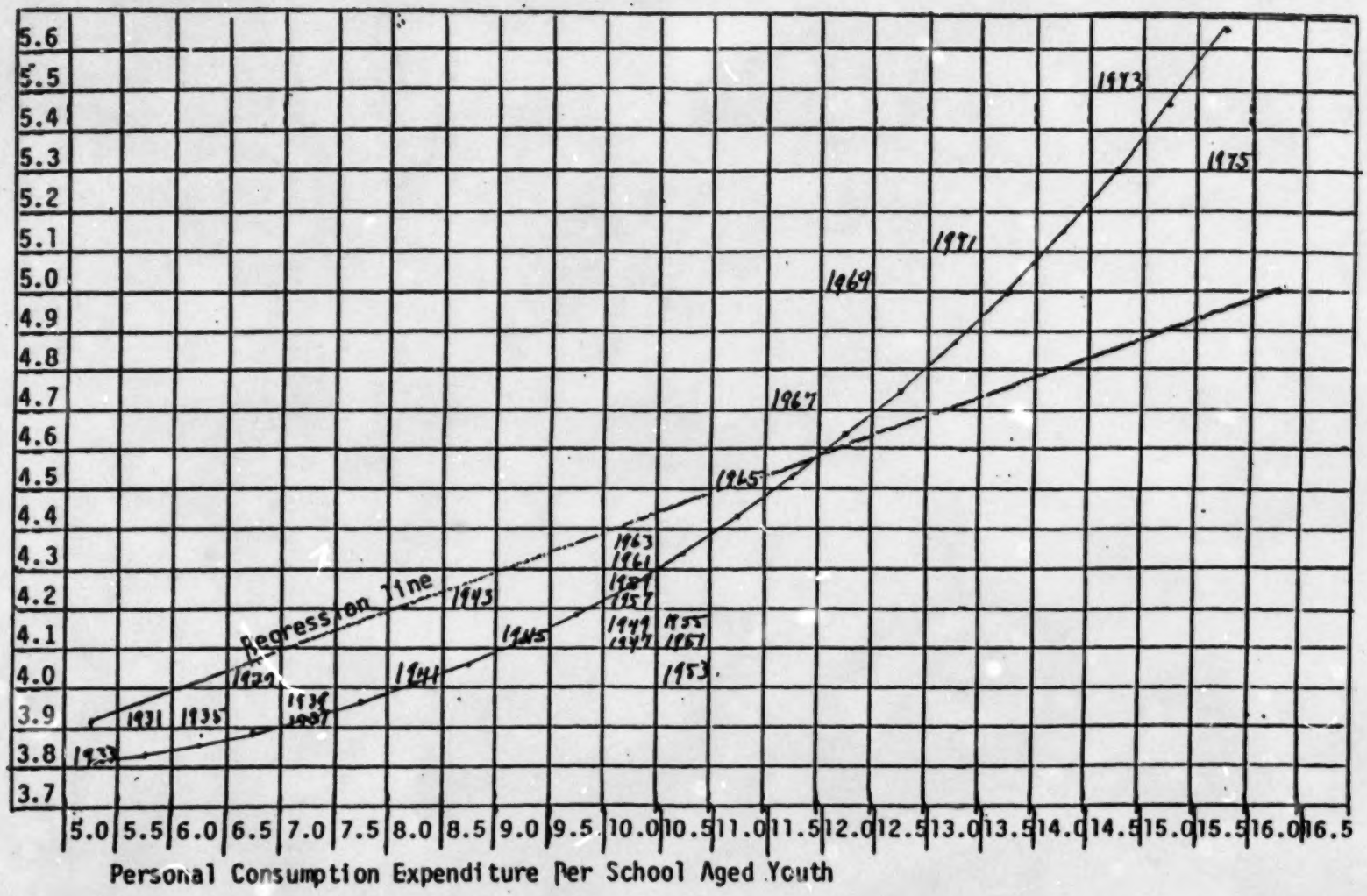
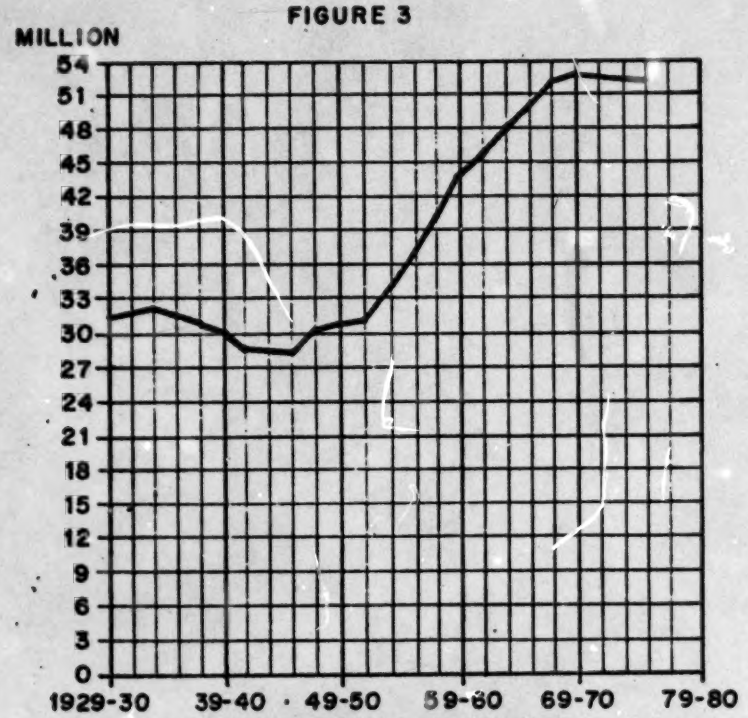


Figure 9. Cross Tabulation of Teacher Pupil Ratio and Personal Consumption Expenditure per School Aged Youth

are less abrupt, and the peaks and valleys are less pronounced.

FIGURE 3

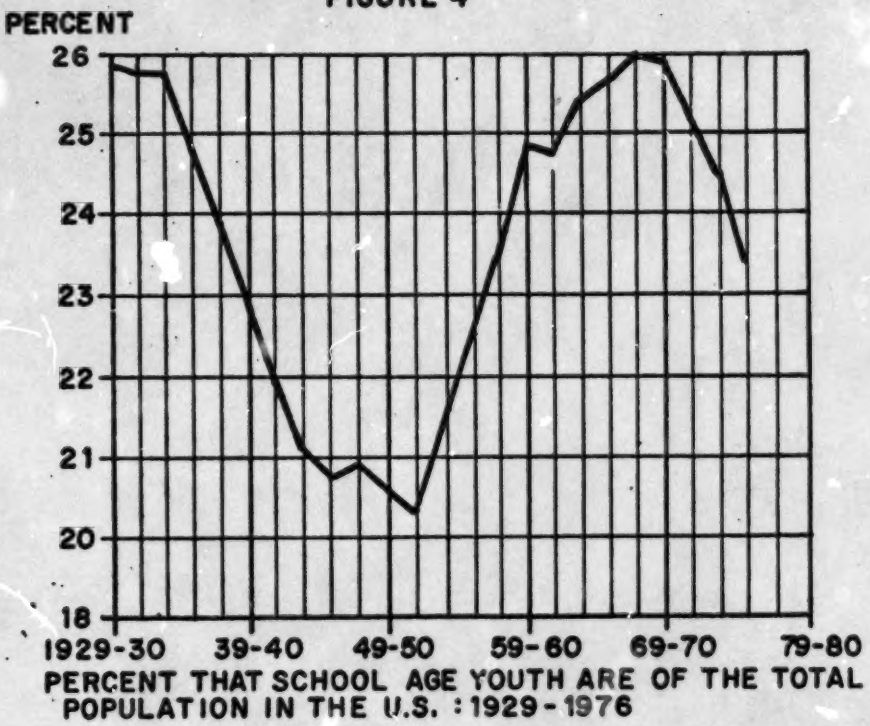


SCHOOL AGE YOUTH IN THE U.S.: 1929-1976
SOURCE: BIENNIAL SURVEY OF EDUCATION (1928-1958);
DIGEST OF EDUCATION STATISTICS (1958-1976)

Figure 4 deals with the same basic data as those in Figure 3, but in Figure 4 they are shown as a percent of the total population, Because the population grew markedly between 1929 and 1977, the shape of Figure 4 is quite different from Figure 3. The three primary differences are (a) though there are far fewer school age youth in the early thirties (about 32M) then there were in the sixties (about 52M) (See Figure 3.) they constituted essentially the same percentage of the total population, approximately twenty-five percent; (b) although there was only a slight decrease in the number of school aged youth in the late 1930s and early forties, there was a sharp decrease in that group as a percent of the total population. Furthermore, the percentage continued to decrease clear into the 1950s, after the numbers actually were increasing; and (c) the 1970s decrease in

the percent that school aged youth were of the population was much steeper than the decrease in numbers.

FIGURE 4



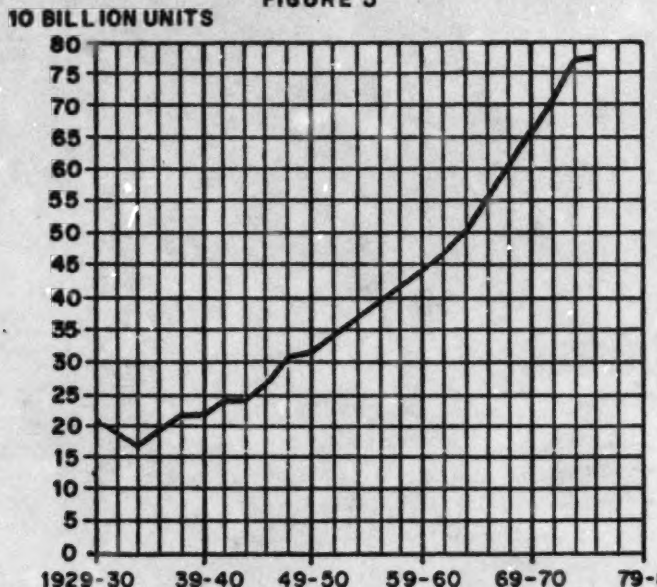
PERCENT THAT SCHOOL AGE YOUTH ARE OF THE TOTAL POPULATION IN THE U.S. : 1929 - 1976

As a portion of any study of the manner in which society allocates its resources in response to changes in the youth population, it seemed important to consider also changes in financial resources available, the reason for this being that a marked increase or decrease in society's ability to pay should influence what it chooses to buy. The index chosen to represent society's ability to pay was personal consumption expenditures (PCE). PCE, essentially the money spent by individuals, was selected as more nearly representing funds available for society to devote to education than, for example, gross national product, the total of all goods and services produced.

PCE, in 1972 constant dollars, is shown in Figure 5 for the U.S. from 1929 to 1978. Except for a brief, depression-years (1929-1933) drop, PCE for the U.S. has increased rather consistently over the past fifty years,

with the most rapid increase occurring since 1961.

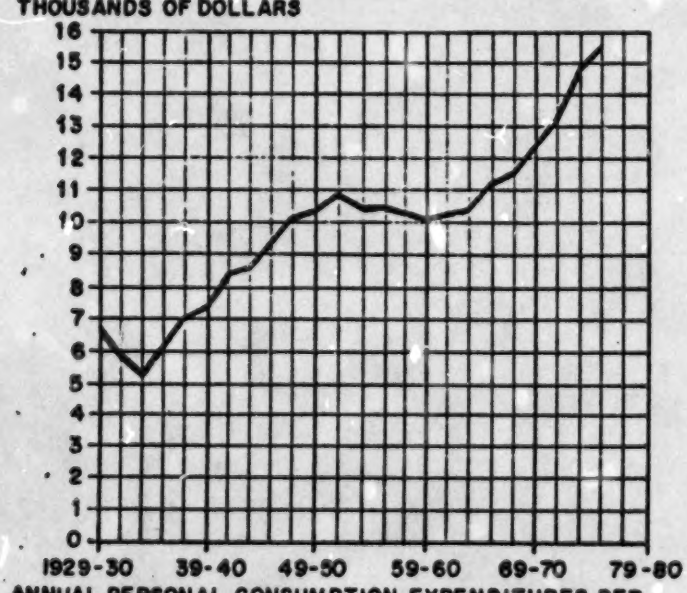
FIGURE 5



PERSONAL CONSUMPTION EXPENDITURES IN THE U.S: 1929-1976
SOURCE: ECONOMIC REVIEW OF THE PRESIDENT, 1972; 1979

Although overall personal consumption expenditure information is useful, an even more directly pertinent index is the amount of money available per school age child. Figure 6, annual PCE per school age youth in the U.S. from 1929 to 1978, shows this information.

FIGURE 6

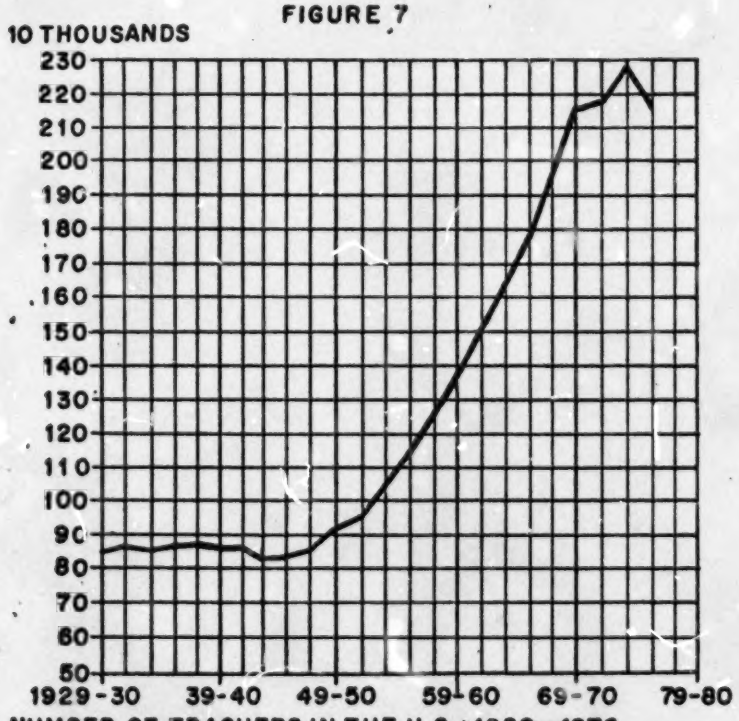


ANNUAL PERSONAL CONSUMPTION EXPENDITURES PER PER SCHOOL AGE YOUTH: 1929-1976

Annual PCE per school aged youth, in 1972 constant dollars, dropped from about $6,800 in 1929 to just over $5,000 in 1933. For the next twenty years the PCE per school aged youth increased, reaching a peak of almost $11,000 in 1951; from then, the PCE per school aged youth levelled, remaining between ten and eleven thousand dollars until 1963 when it again began to rise. By 1975 it had reached $14,500.

In Figure 7, the annual trend is graphed for the number of teachers of K-12 youth.

FIGURE 7

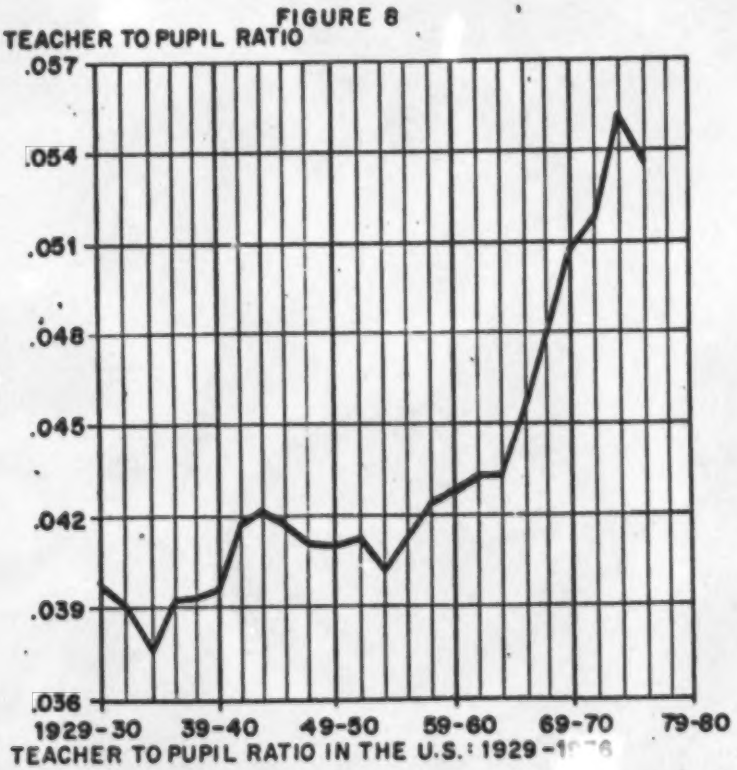


NUMBER OF TEACHERS IN THE U.S.: 1929 - 1976
SOURCE: BIENNIAL SURVEY OF EDUCATION (1928-1958);
DIGEST OF EDUCATION STATISTICS (1958-1976)

From 1929 to 1949, this number ranged from 800,000 to 900,000; then, in 1951, when the number of school aged youth began to rise rapidly, the number of teachers did also, more than doubling by 1965 and reaching a peak of almost 2.2M in 1973-74.

Teacher-pupil ratio in the U.S. from 1929 to 1975 is shown in Figure 8. Although the number of teachers began to increase rapidly in the early 1950s, the teacher to pupil ratio remained rather constant, between 3.8 and 4.4 teachers per hundred pupils, from 1929 to 1963, but beginning in 1965 this ratio began to increase, reaching a peak in 1973-74 of more than 5.6 teachers per hundred pupils, before it dropped off once more in 1975-76.

FIGURE 8



TEACHER TO PUPIL RATIO IN THE U.S.: 1929-1976

Results

As is noted in the preceding discussion, both the personal consumption expenditure per school aged youth and the teacher pupil ratio increased substantially over the period from 1929-30 to 1975-76. For the purposes of this study, it is assumed that a part of the reason for the improved (increased) teacher pupil ratio was the increase in personal consumption

expenditure per school aged youth. Consequently, the relationship between these two variables is an integral part of the analysis that follows. Changes projected for the teacher pupil ratio are not simply changes from one year to the next, but a changing relationship between the actual teacher pupil ratio and the one predicted from the personal consumption expenditure per school aged youth.

To provide a basis for the analysis, a set of hypotheses are proposed. These hypotheses are then tested against the data. The hypotheses, shown in Table 1, were based upon the general hypothetical structure stated at the beginning of this paper and on the data presented in figures three and four.

Table 1

Changes in Teacher Pupil Ratio Predicted from Data in Figures Three and Four

	Figure Three		Figure Four	
Years	Predicted Change	Reason for Prediction	Predicted Change	Reason for Prediction
1929-34	None	No change in number of SAY*	None	No change in percent of SAY*
1934-38	Possible increase	Some drop in number of SAY	Increase	Sharp drop in percent of SAY
1938-42	No change	If there was an increase in 1934-38, society should accommodate by this time	Levelling, to possible decrease	Society should begin to accommodate despite continued drop in percent of SAY
1942-46	No change	No change in number of SAY	Decrease	Society should correct for earlier increase
1946-52	Possible decrease	Slight increase in number of SAY	No change	No change in number of SAY
1952-58	Decrease	Substantial increase in number of SAY	Decrease	Substantial increase in percent of SAY
1958-62	Possible levelling	Society should begin to correct for earlier decrease	Possible levelling	Society should begin to accommodate
1962-68	Increase	Society should begin to correct for earlier decrease	Increase	Society should begin to correct for earlier decrease
1968-76	Rapid increase	Substantial decrease in number of SAY	Rapid increase	Substantial decrease in percent of SAY

*SAY refers to School Aged Youth

Hypotheses are presented separately for data from Figure 3, number of school aged youth in the population, and Figure 4, percent that school aged youth are of the total population. This was done because the trends for the two data sets are somewhat different and we do not yet have firm evidence of which may be a more important determiner of society's response.

Once the hypotheses had been formulated, the data were analyzed. The analysis consisted of computing a correlation coefficient (r) and both linear and non-linear regressions between personal consumption expenditure per school aged youth and teacher pupil ratio and then comparing the projected year to year changes in teacher pupil ratio with the relationship between the observed ratios and the regression line.

Figure 9 is a cross tabulation of the data for teacher pupil ratio and personal consumption expenditure per school aged youth. The correlation (r) between these two variables is high (0.84); however, the important issue for this study is not the size of this correlation. Rather, it is the position of the tallies for the several years in relation to the regression line. Both linear and several non-linear regressions were computed. The formula for the linear regression was $Y^1=2.72+0.164X$; for the selected non-linear regression, $Y^1=3.7+0.00051(X^3)$. As can be seen from Figure 9, many of the year-tallies are located some distance from both regression lines. It is these departures from the regression curve, compared with the hypotheses, that forms the analysis for this study. (The non-linear regression was chosen because it accounts for more of the variance.)

Table 2 summarizes a year by year comparison of predictions from the hypotheses with the actual data for those same years. Table 2 has six columns (1) year, (2) teacher pupil ratio differences from the regression line as predicted from Figure 3 (changes in size of the school aged population) (3) teacher pupil ratio differences from the regression line as predicted from Figure 4 (changes in percent that the school aged population is of the total population), (4) actual differences and shifts in relation to the regression line with those which actually took place.

The symbols in columns two through six require some explanation. The explanatory notes are given in Table 3.

Table 2

Comparison of Actual Shifts in Teacher Pupil Ratio with Those Predicted from Changes in Youth Population When Personal Consumption Expenditure per School Aged Youth Is Controlled

	Predicted			Comparison	
Year	Figure 3	Figure 4	Actual	Figure 3	Figure 4
1929-1934	0	0	-	0	0
1934-1938	?+	+	0	0	0
1938-1942	0	?-	0	A	0
1942-1946	0	-	0	A	0
1946-1952	?-	0	-	?A	0
1952-1958	-	-	+	Di	Di
1958-1962	?+	?+	+	?A	?A
1962-1968	+	+	+	A	A
1968-1974	++	++	+	A	A

Table 3

Explanation of Symbols Used in Table 2

	Columns	
Symbols	Two and Three	Four
+	Positive shift	Positive difference of at least .1 between Y (actual teacher pupil ratio) and Y' (predicted teacher pupil ratio) or a positive shift of at least .1.
?+	Possible positive shift	
0	No change	Less than .1 difference between Y and Y' and no shift as great as .1
-	Negative shift	Negative difference of at least .1 between Y (actual teacher pupil ratio) and Y' (predicted teacher pupil ratio) or a negative shift of at least .1.
?-	Possible negative shift	

Symbols	Columns Five and Six
A	Agreement between predicted and actual
?A	Prediction of "possible" and actual move in same direction
0	Prediction not supported
?Di	Prediction of "possible" and actual move in opposite direction
Di	Disagreement between predicted and actual

Discussion

Teacher pupil ratio in the U.S. public schools has, indeed, been increasing for a number of years. However, in the quarter century between 1929-30 and 1955-56, the ratio increased only one tenth of one teacher per hundred pupils; in the ten years between 1963-64 and 1973-74, it increased by one and two-tenths teachers per one hundred pupils.

During the almost fifty years covered by this study, there was a marked constant dollar increase in the personal consumption expenditure per school aged youth from approximately 6590 dollars in 1929-30 to over $15,000 in 1975-76. As might be expected, there is a very high correlation between personal consumption expenditure per school aged youth and teacher pupil ratio. Even when variables are highly correlated, however, some individual observations do not fall on the regression line. It was the pattern of these departures from the regression line, compared with predicted departures, that comprised the data for this study.

Data reported in this study at least partially support the assertion made by Egbert, et. al. that there is a delay in society's response to rapid changes in the youth population, but that ultimately society does accommodate. The data are substantially more supportive of the assertion as it relates to the number of youth (agreement with prediction in six of nine time intervals) than to youth as a percent of the total population (agreement with prediction in threeof nine time intervals). However, there have been only two abrupt, major reversals in the size of the youth population during the period for which there also is reasonably good information on teacher-pupil ratio. Within that limitation, the assertion is supported reasonably well.

In only one time interval, 1952-1958, was there disagreement between prediction and what actually occurred, and the disagreement was present for both actual number of school aged youth and the percent that they were of

the population.

The predictions for 1952-58 were that, as the number of youth increased and as they increased as a percent of the total population--both of which occurred between 1952 and 1953--the teacher pupil ratio would decrease relative to the regression line. In fact, the teacher pupil ratio did decrease slightly between 1952 and 1954, but it then gained until 1958. Society responded more quickly than we predicted.

The initial statement of theory was limited entirely to increase and decrease in actual numbers in the youth population. However, when major differences were noted between the curves representing number and those representing percent that those numbers were of the population, we began speculating which dimension of "size of the youth population" might be more important, if, in fact, either was significant in its impact. A reasonable assumption might be that the nature of issue being considered is the prime determinant in which of these two indices of size of the youth population is more important. Certainly in this study number appears to be of greater import. This may well be because the size of the preschool population was also changing very rapidly during much of this period. Inclusion of that group in computing percent, a very large group which had no vote in determining school expenditures, could have distorted the overall importance of percents.

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